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Study of mathematics anxiety in high school students and it's relationship with self-esteem and teachers' personality characteristics

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Abstract

The present research attempts to study the relationship between the mathematical anxiety among high school students and their self-esteem and teachers' personality characteristics. From among the high school students some 480 people were chosen categorically in accordance with their characteristics and 60 mathematics teachers were also chosen through this method. The data were collected through the use of self-esteem questionnaire of Cooper Smith and Mathematics Anxiety Questionnaire and personality questionnaire by Neo. After data analysis, the following findings were concluded: There is negative significant relationship between the students, mathematical anxiety and their self-esteem. There is also a significant relationship between the students, mathematical anxiety and their teacher's personality characteristics. There is not significant relationship between the high school students mathematics anxiety and their educational levels. There is a significant difference between the mathematical anxiety of moreover students majoring in humanities and natural science students and the students of physics and mathematics students. There is a significant difference between the mathematics anxiety of male and female students.

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Keywords: Mathematics anxiety, Students, Self-esteem, Personality characteristics;

Introduction

We should acknowledge that the importance and fundamental role of mathematics is undeniable in the history of scientific thought, and even in the course of industrialization and technological developments. However, "mathematics anxiety" is one of the factors, which can be a hindrance on the way of studying mathematics, and positive factors associated with it. More than four decades pass since the first time the term "mathematics anxiety" has entered into the glossary of psychology terms. During this period, although a more clear perspective has been achieved, there is a long way to understand the structure and its dynamics thoroughly (McCoy 1992; quoted from Shokrani, 2002). "Mathematics Anxiety" is a psychological status, which come forth in people when dealing with

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mathematical content whether in teaching and learning situation or in solving mathematical problems and assessing the mathematical behavior (Alam al-Hoda, 2000). Although for many years researchers have investigated the causes of mathematics anxiety, there has not been presented any integrated approach in math anxiety development**.** Since the environmental factors have a high impact on human personality development "ego" or its meaning, which is one of the main dimensions of human personality is influenced by environmental factors. Therefore, the present study aims to address the relationship between the students' mathematics anxiety and their self-esteem and the personality characteristics of their math teachers. Sherman and Elizabeth Fenma, 1998, indicated in a research that the lack of sufficient background in mathematics to do mathematical activities and low self-esteem in mathematics will reinforce math anxiety. Occasionally, we could observe that even relatively good math students, due to lack of proper mathematical sense of confidence, experience fear, and anxiety with slight variations in the conditions. Vayne and colleagues (2004) showed in a research that math anxiety is one of the most serious limitations for training, so that it could cause a fear of working with numbers, or understanding of mathematical theories aims (theoretical support) and solving practical problems in everyday life**.**

In a research conducted by Paeinkerton (2005), it became clear that math anxiety develop in children before school by parents and in school by teaching methods. Although many scientists have defined "math anxiety" as irrational and unreasonable fear, in fact, what happened is a real fear resulting from past mathematical experiences (such as learning styles, past experience, teachers personality, poor books, teachers attitudes, classroom environment, time limitations, self-esteem and image that students have from their abilities in math learning as well as the stress and pressures parents and teachers put on students). In another study conducted by Leily Abadi (2004) the results of multivariate analysis of variance (MANOVA) showed that there was a significant difference between girls' and boys' mathematics anxiety, and mathematics anxiety in boys is higher than that of girls. The present study performed with the aim of determining the level of mathematics anxiety among high school students and its relationship with the students' self-esteem and personality traits of math teachers**.**

Methods

The present research is a correlational study. The statistical universe of this research includes all high school students of Ardabil city in Iran, and their math teachers in academic year of 2007-8. The number of samples was 480 male and female students in first, second and third grade high school and pre-university level and their math teachers. In this study we used the stratified sampling method. To collect the required data we used the questionnaire. Preparing the students' list and selecting them the aim of research was explained to them. Then, the research tests were given to them. They were asked to express their opinion carefully. The information was gathered collectively at school, and then obtained data were an analyzed using SPSS tools, one-way ANOVA, Scheffe post hoc test, the t-test, and the correlation coefficient. Its aim was determining the statistical characteristics from descriptive statistics (mean, standard deviation, etc.).

Mathematics Anxiety Rating Scale (MARS)

Mathematics Anxiety Scale, which is called MARS in this study, has two agents of Mathematics Test Anxiety (MTA) and Mathematics Test Anxiety (MNA) including 18 items. For assessing the reliability of this scale, the two methods of Test-Retest and Internal Consistency (Cronbach's alpha) have been used. The correlation coefficient between subjects' scores (high school students) in two cases of test and retest has been obtained as $r=0.892$, which is statistically significant at the level of $P<0.01$. Cronbach's alpha coefficient for the total subjects has been obtained equals to $a=0.922$ (Shokrani, 2002). In order to evaluate the validity of MARS, the correlation coefficient of this test has been obtained equals to ($r=0.543$) using Cattell Anxiety Scale (Sarmad, Bazarghan and Hejazi, 1997).

Self Esteem Inventory

Several scales have been provided to assess self-esteem. One of the commonest scales is the self-esteem questionnaire of Cooper-Smith. This questionnaire is comprised of five categories: 1- Doing teaching assignments, 2- Social relations, 3- Family, 4- Self (ego), and 5- the future. This questionnaire includes 58 articles. The score range is between zero and fifty. The closer the scores to fifty, the higher the self-esteem will be. Test and retest reliability coefficient from self-esteem scale, with a five-week time interval was equal to 0.88 in a group of students and in another sample of students, with a three-year time interval was 0.70 (Cooper-Smith, 1992; Quoted by Poursina, 2003).

Five Factor Inventory (NEO)

The final revised form of NEO test including 240 items was presented by Costa and Mac Kerry in 1992. This scale covers big five dimensions of personality traits including: Extraversion, Neuroticism, Openness to Experience, Conscientiousness, and Agreeableness. Each dimension is comprised of 6 components. The chart "A" shows the validity and reliability coefficients of this test with separate quintet dimensions (Gross, 1998).

Results

Table 1. Standard Deviation and T-test Mean of data associated with mathematics anxiety of boys girls

Variables	N	$\overline{X}$	S	T
Mathematics anxiety of boys	206	36.22	7.37	3.11
Mathematics anxiety of girls	274	26.47	5.07	--
Total	480	--	--	--

As you can see in Table 1, since the calculated t (t = 3.11) is greater than (t 0.01) = 2.576), degree of freedom in the table is 478, Thus, null hypothesis is rejected, we conclude with 0.99 confidence that there is a significant differences between the compared averages, meaning that mathematics anxiety of female students is significantly higher than mathematics anxiety in male students ($P<0.01$).

Table 2. Correlation coefficient of data associated with mathematics anxiety of students, with students' self esteem, educational level, educational field, and their social and economic status

Groups	Students' self esteem	Social and economic status
Mathematics anxiety of girls	-0.588	-0.158
Mathematics anxiety of boys	-0.61	-0.144

As you can see in Table 2, the calculated coefficient between the female students' math anxiety rate, with their self-esteem equals to (r=0.588). In addition, the calculated correlation coefficient between mathematics anxiety rate of male students and their self-esteem is r=0.61, and shows an inverse relationship between these two variables, meaning that as the student's self-esteem is higher, their mathematics anxiety will be less. As for Fisher's Z-test, the difference between two correlation coefficients is not significant. The calculated correlation coefficient between math anxiety rate among female students in their educational level is equal to (r=-0.1656). In addition, the calculated correlation coefficient between math anxiety rate among male students in their educational level is (r=-0.1723), which represent a significant inverse relationship between these two variables. This means that as students are entering higher education levels, their mathematics anxiety becomes less. According to Fisher's z test, the difference between the two correlation coefficients is not significant. The calculated correlation coefficient between math anxiety rate of female students, and their social and economic status is equal to (r=-0.158). Moreover, the calculated correlation coefficient between math anxiety rate of male students, and their social and economic status is equal to (r=-0.146), which show an inverse relationship between two variables. The relationship between these two variables is significant in both sexes. According to Fisher's z test, there is no significant difference between the two correlation coefficients.

Table 3. Analysis of one-way variance of students in various fields for the scores of mathematics anxiety

Change resources	df	Sum of squared	F	Significant Level
Between the group	2	2324.083		
Within a group	477	2120.83	10.958	0.00
Total	479			

As you can see in Table 3, since the calculated F (F = 10.958) is greater than F (P<0.01) with freedom degrees of 477 and 2, null hypothesis is rejected and we can conclude with 0.99% confidence that there is a significant difference between means of the compared groups.

Table 4. Scheffe post hoc test to compare the means

Groups	X1 Humanities	X2 Experimental Science	X3 Technical-Math group
X1 Humanities	-	*	*
X2 Experimental Science	*	-	-
X3 Technical-Math group	*	-	-

As you can see in Table 4, we have used the Scheffe test to determine the difference between each pair of means. The result of this comparison showed that mathematics anxiety in Technical-Math group in mathematics is significantly lower than that of humanities group. Furthermore, mathematics anxiety in Experimental Science group is significantly lower than that of the Humanities, but there is not a significant difference between the two groups of Experimental Science and Technical-math one.

Table 5. Correlation coefficient of data associated with math anxiety of students with personality traits of their teachers

Variables	mathematics anxiety of boys	mathematics anxiety of girls
Neuroticism	0.105	0.141
Extraversion	-0.141	-0.8
Flexibility	-0.112	-0.143
Agreeableness	0.10	-0.146
Responsibility	-0.1396	-0.168

As can be seen in Table 5, there is a significant relationship between the personality traits of male mathematics teachers, and boys' anxiety in both extraversion and responsibility factors (P<0.01). This means that high extraversion personality traits have a significant contribution in explaining the variance in mathematics anxiety of boys. In addition, high responsibility plays its role in explaining the variance of mathematics anxiety. In three other factors, the relationship is not significant. However, measuring personality traits of female mathematics teachers indicate that the four personality factors of Neuroticism (r=0.141), Flexibility (r=0.143), Agreeableness (r=0.146) and responsibility (r-0.168) have a significant relationship with mathematics anxiety of girls. Only we cannot see a significant relationship with Extraversion factor.

Using chi-square test showed that there is a significant relationship between the personality traits of teachers and mathematics anxiety of students.

Table 6. One-way analysis of variance (ANOVA) in different educational level students, for grades of mathematics anxiety

Resource	df	Sum of squared	F	Significant Level
Between the group	3	1255.26		
Within a group	476	396.88	3.1628	0.062
Total	479			

As you can see in table 6, since the calculated F = (3.1628) is smaller than F in table with various freedom degrees of 476 and 3, null hypothesis is confirmed. We conclude that there is no significant difference in terms of mathematics anxiety among different educational levels.

Discussion

Numerous studies findings show the effects of demographic variable of gender on academic achievement in mathematics (e.g, Feingold, 1998; Cusey; Natal; Pezaris; Ben Bow; 1995). Some researchers believe that math performance is influenced by social and cultural factors (Brandon, Newton, Hammond, 1987 quoted by: Reyr, 1980 Wood, 1998, Kramer, 1992). The level and type of class assignment or math test, also determine the gender differences in mathematics (Keymba, 1989; Fenma and Damon, 1990 and Seyf 1997). Parent education level is another demographic variable, which the results of studies indicate its effects on academic achievement. This variable is one of the most important indicators of social and economic class (Carpenters and Hayden, 1989; Mehryar, 1972, Khayer. 1986 and 1997 quoted from Taqvaei, 2002.

Fenma Motivation Model (1989) confirms this point and a positive attitude about math and math anxiety relationship in it play a preventive role. It is necessary to mention the point that we have seen the strongest correlation between negative feelings toward mathematics, and the attitude of "agreeableness variable". This shows that the negative feelings about math, which include unwillingness to become involved with the assignments in this course, is feeling ill and tiredness of performing mathematical tasks and related courses. The results obtained from the Researches conducted by Neyers, 2002; Neyers, 1998 and Markyshor, 1997 showed that students who love math and enjoy involving in the activities required applying mathematical knowledge gain more academic achievement in math courses. Conversely, students who experience a range of negative emotions such as irritability and lack of peace to confusion, distress and fear of math, will have less success in this course (Fenma, 1989; Kirk, 2002).

Neyers (2002) suggests that one of the ways to improve math performance and reduce math anxiety, is utilizing formal math teaching beside math students and dealing with negative feelings against this course. Here, the teacher's personality traits, such as high flexibility, high agreeableness, conscientiousness and being responsible and emotional stability can be very useful and effective in this field. The findings of several researches show that providing opportunities for cooperative, moderate and competitive learning at schools can reduce the students' anxiety (Slavin, 1990). In addition, Diversity in teaching methods and evaluation methods of students (based on the mightiness of flexibility in character) is another way to reduce mathematics anxiety in the educational environments (woolfolk, 1993 quoted from O'dea, 2006).

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